

CLAIMS

1. A method of purifying wastewater including the steps of:

(i) passing the wastewater through an electrocoagulation cell which comprises a plurality of reaction plates or electrodes disposed within said cell and spaced apart from each other, whereby said wastewater is treated by passing an electric current through the wastewater producing an electrochemical reaction which generates a floc in the electrocoagulation cell, whereby the floc binds or absorbs impurities present in the wastewater;

(ii) passing the wastewater containing said floc having bound thereto said impurities into a coagulation tank or settling tank whereby said floc is discharged from the tank to produce purified water without addition of flocculant or coagulant to the wastewater or use of an additional separating device such as a magnetic separator;

(iii) re-using said purified water for cleaning or other purposes to produce wastewater; and

(iv) recycling the wastewater back to the electrocoagulation cell.

2. A method of purifying wastewater from a vehicle wash facility including the steps of:

(vii) collecting wastewater from a first vehicle being cleaned in said facility in a tank or sump;

(viii) transferring said wastewater from the tank or sump to an electrocoagulation cell;

(ix) passing the wastewater through an electrocoagulation cell which comprises a plurality of reaction plates or electrodes disposed within said cell and spaced apart from each other, whereby said wastewater is treated by passing an electric current through the wastewater producing an electrochemical reaction which generates a floc in the electrocoagulation cell, whereby the floc binds or absorbs impurities present in the wastewater;

(x) passing the wastewater containing said floc having bound thereto said impurities into a coagulation tank or settling tank whereby said floc is discharged from the tank to produce purified water without addition of flocculant or coagulant to the wastewater;

(xi) re-using said purified water for cleaning a second vehicle in said facility to produce wastewater; and

(xii) recycling the wastewater back to the electrocoagulation cell.

3. The method of claim 1 or claim 2 wherein froth and oil from the wastewater is discharged from the settling or coagulation tank adjacent the top thereof by gravity.
- 5 4. The method of claim 1 or claim 2 wherein the wastewater is filtered prior to passing the wastewater through an electrocoagulation cell to remove large particles, if present, from the wastewater. 5. The method of claim 4 wherein particles with a size greater than 200  $\mu\text{m}$  are removed.
- 10 6. The method of any one of claims 1 to 4 wherein the wastewater is passed through one or a plurality of pre-treatment tanks to remove heavy oils, sludge and fuel, if present, from the wastewater.
7. The method of claim 1 or claim 2 wherein direct current is applied to the reaction plates or electrodes of the electrocoagulation cell.
- 15 8. The method of claim 1 or claim 2 wherein the electrocoagulation cell is orientated vertically so that an outlet conduit is located at the top of the electrocoagulation cell and an inlet conduit is located at the bottom of the electrocoagulation cell.
9. The method of claim 1 or claim 2 wherein the voltage applied to the electrodes falls within the range 10-110 volts.
- 20 10. The method of claim 9 wherein the voltage applied to the electrodes falls within the range 20-80 volts.
- 11 The method of claim 9 wherein the voltage applied to the electrodes falls within the range 20-60 volts.
12. The method of claim 1 or claim 2 wherein the current applied to the reaction plates or electrodes falls within the range 2-100 amps.
- 25 13. The method of claim 12 wherein the current applied to the reaction plates or electrodes falls within the range 5-60 amps.
14. The method of claim 12 wherein the current applied to the reaction plates or electrodes falls within the range 5-20 amps.
- 30 15. The method of claim 1 or claim 2 wherein the electrodes are manufactured from a metal selected from the group consisting of aluminium, steel, iron, titanium, silver

and brass.

16. The method of claim 15 wherein the electrodes are manufactured from aluminium or titanium.

17. The method of claim 1 or claim 2 wherein 2 to 75 electrodes are used in the cell.

5 18. The method of claim 17 wherein 2 to 26 of the electrodes are connected to the power supply.

19. The method of claim 1 or claim 2 wherein the flow rate of wastewater through the electrocoagulation cell falls within the range 2-1000 L/min.

10 20. The method of claim 19 wherein the flow rate falls within the range 5-200 L/min.

21. The method of claim 19 wherein the flow rate falls within the range 10-50 L/min.

15 22. The method of claim 1 or claim 2 wherein the purified wastewater is discharged into one or a plurality settling tanks for separation of contaminated floc, if present, from the purified wastewater.

23. The method of claim 22 wherein the settling tanks are connected to a rainwater collection tank to allow collected rainwater to be discharged into the settling tanks to increase the volume of water available for recycling.

20 24. The method of claim 1 or claim 2 wherein the purified wastewater is filtered prior to re-use.

25. The method of claim 24 wherein particles with a size greater than 10  $\mu\text{m}$  are removed.

26. The method of claim 1 or claim 2 wherein the purified water is stored in a storage tank before re-use.

25 27. The method of claim 1 or claim 2 wherein the purified water is stored in a sump after re-use.

28. The method of claim 1 or claim 2 wherein after the wastewater has passed through the coagulation or settling tank the wastewater is passed through a reverse osmosis system.

30 29. The method of any one of claims 1, 2 or 26 wherein the wastewater is passed through a de-chlorination system after the wastewater has passed through the

coagulation or settling tank.

30. The method of any one of claims 1, 2, 28 or 29 wherein the wastewater is passed through a water softening system after the wastewater has passed through the coagulation or settling tank.

5 31. The method of claim 1 wherein prior to step (i) the wastewater may be obtained from public or household showers, sinks, basins, baths, washing machines, dishwashers, kitchens or car washes and may be initially stored in a collection tank or sump.

32. A closed circuit system for purifying wastewater from a vehicle wash facility comprising:

10 (i) a wastewater collection zone for collection or drainage of wastewater obtained from cleaning vehicles;

(ii) an electrocoagulation cell comprising a plurality of reaction plates or electrodes spaced apart from each other for processing wastewater so as to produce a  
15 floc in the electrocoagulation cell whereby the floc binds or absorbs impurities present in the wastewater;

(iii) a coagulation or settling tank for separating the floc from the purified water; and

(iv) an application zone for application or use of the purified water for  
20 cleaning vehicles.

33. The system of claim 32 wherein the system includes one or a plurality of pre-treatment tanks for the removal of fuel, sludge and heavy oils, if present, from the wastewater upstream of the electrocoagulation cell.

34. The system of claim 32 wherein the coagulation or settling tank includes a  
25 collection tank for the collection of rainwater.

35. The system of any one of claims 32 to 34 wherein the system includes one or a plurality of filters upstream of the electro coagulation cell.

36. The system of any one of claims 32 to 35 wherein the system includes a reverse osmosis system downstream of the settling or coagulation tank.

30 37. The system of any one of claims 32 to 36 wherein the system includes a water softening system downstream of the settling or coagulation tank.

38. The system of any one of claims 32 to 37 wherein the system includes a de-chlorination system downstream of the settling or coagulation tank.

39. The system of claim 32 wherein the application zone includes a storage tank or sump.

5 40. The system of claim 32 wherein the application zone is a cleaning zone and the wastewater or grey water produced in said cleaning zone contains detergents and cleaning agents.

41. The system of claim 32 wherein the system includes a collection conduit for recycling the wastewater back to the electrocoagulation cell upstream of the  
10 wastewater collection zone.

42. The system of claim 32 and claim 41 wherein the collection zone includes a storage tank or sump.

43. The system of claim 32 wherein the system is automated.

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